

Exploring Green Energy Alternatives: Comparative Study of Banana Peel Waste, Water Apple Waste and Lime Waste as Alternative Energy Sources Through the Use of Batteries

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Abstract

Alternative energy is energy obtained through renewable energy sources, and can be recovered. Alternative energy is energy that is used as a substitute for the main energy. The purpose of the study was to determine and compare the potential of fruit waste used as an alternative energy source through the use of batteries. his research is a laboratory-based study using experimental methods used to compare the success of biobatteries on fruit waste tested on wall clocks. This study utilizes fruit that is no longer used or rotten. The fruit waste used is banana peel waste, water apple waste, and lime waste. The results of experiments in this study showed that waste from rotten water apple is higher in energy than banana and lime peels. The utilization of banana peel waste lasts from 15.20 to 18.45, while water apple waste from April 27 at 12.55 to May 4 at 05.30, and lime waste tarting from Saturday, April 27, 2024, at 2:48 PM, until the clock eventually stopped on Monday, April 29, 2024, at 4:50 PM. This proves that banana peel waste, water apple waste, and lime waste are proven to be used as biobatteries and can be used as alternative energy.

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Introduction

Indonesia is one country that still depends on oil and coal as its main energy sources. Currently, the amount of oil and coal supplies is decreasing because the characteristics of these energy sources are not renewable. Conversely, energy needs are increasing so that the search for new energy arises as an alternative effort to meet energy needs. Alternative energy is energy obtained through renewable energy sources, recoverable, or eternal. Currently, research on alternative energy is increasingly being carried out, especially alternative energy sourced from nature and can be renewed. In this modern era, the energy crisis is a very bad threat to human survival. Many researchers are currently developing battery replacements. These include bio-batteries, which were first popularized by Professor Kenji Kano of Seito University. The professor explained that the energy sources of biobatteries are carbohydrates, glucose, amino acids, and enzymes (Urba et al., 2013)

Batteries have become familiar items to us. Batteries are one source of electrical energy and remain an important need in everyday life, especially for electronic devices. Batteries are widely used in all aspects of daily life, such as TV remote controls, wall clocks, flashlights, and children's toys. The battery is one of the media that can convert energy. The energy produced is an electrochemical oxidation and reduction reaction that occurs at the electrode (Chang, 2005). Over time, researchers develop organic biobatteries that are environmentally friendly, free of harmful chemicals, and relatively inexpensive. Responding to public concerns regarding the impact of battery waste which is very harmful to the environment, Urba et al. (2013) found that natural materials can be used in the production of biobatteries.

Banana peel waste, water apple waste, and lime waste are examples of organic waste that can be processed as alternative energy sources. This research involves lab work to test the performance of batteries made from all three types of waste. The purpose of this study was to compare the electrogenic potential of banana peel waste, water apple waste, and lime waste in the utilization of electrical energy with batteries. This research is expected to provide valuable information on the suitability of the waste as an alternative energy source that is environmentally friendly and sustainable.

Methods

This research is laboratory-based research using experimental methods. In this case, researchers used banana peel waste, water apple waste and lime waste to make bio batteries as an alternative energy source. Then an analysis is carried out based on the data to compare the electrical energy contained therein. The following are the tools and materials for making bio-batteries from used batteries, banana peel waste, water apple waste, lime waste, insulating screwdrivers and wall clocks. Making this media begins by making a paste of banana peel waste, water apple waste, and lime waste which will replace the paste in used batteries. The waste is crushed then put in a used battery and carried out experiments on a clock. Battery bio timeout record and analysis.

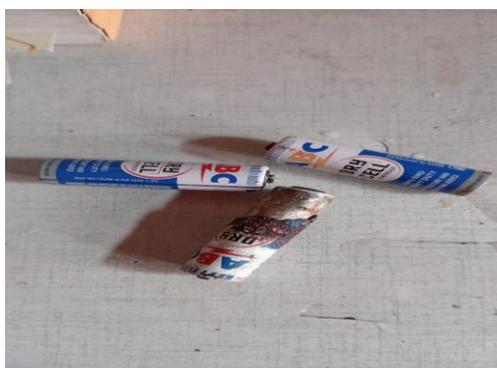
Result and Discussion

Electrical energy becomes an important part of humans and is used in everyday life. Electrical energy is a primary need for humans. Unfortunately, electrical energy is not a necessary energy. One of them is obtained from petroleum which is getting thinner and thinner, and there will be a time when electrical energy will run out. Electrical energy is stored in various places, one of which is the battery. Batteries are used by humans in everyday life, such as on TV and AC remotes, clocks, children's toy flashlights, radios, and so on. However, batteries have hazardous materials.

In addition, battery waste has a bad impact on the surrounding environment, so there is a need for initiatives to reduce the impact of battery waste in the environment, as well as become alternative energy to replace electrical energy.

Table1. experimental results on fruit waste

	Types of Waste	Long Battery Life
1.	Banana peel	3 Hours
2.	Water apple	1 Week
3.	Lime	2 Days



Gambar 1. Used batteries



Gambar 2. Banana peel waste



Gambar 3. Lime peel waste, pasta making procees, lime peel pasta battery



Gambar 4. Fruit Waste battery clock

Decaying fruit and vegetable waste undergoes a chemical process, namely fermentation. In the fermentation process fruits and vegetables produce more acid which can increase the strength of electrolytes in fruits and vegetables. So that rotten fruit will produce higher voltage compared to fresh fruit. Fruit waste that is considered waste can be used as an alternative energy source. Experiments conducted on fruit waste include banana peel waste, water apple waste, and lime waste. Experiments were conducted to find out which fruit waste has a greater current and voltage value.

Banana Peel Waste

Banana peel waste contains elements that can be processed to generate electricity, thus banana peels can be used as a replacement for electrolytes in batteries. Banana peels contain Potassium (K^+) minerals which function as electrolytes, and also contain a small amount of sodium salt (Cl^-). The reaction between Potassium and Sodium Salt can form Potassium Chloride. The mineral content and contour of banana peels from various banana types result in unstable ionization.

The voltage remains constant, thus it can be concluded that banana peels have electrolytic minerals capable of conducting electricity. Banana peels that can be used as stable paste replacements are Ambon banana peels, while the best ones are Raja Nangka banana peels. Banana peel waste has been proven to conduct electricity capable of replacing electrolytes in batteries.

Banana peels contain potassium, cotton, and sodium salt which contain chloride Cl^- to form KCl . Strong electrolytes that can ionize and conduct electricity. The electricity flows due to the movement of charge differences between positive and negative poles from the experiment conducted resulting in a battery that lasts for 3 hours from 15:20 to 18:45.

Water Apple Waste

In an experiment utilizing water apple waste by utilizing unused batteries. The experiment was conducted on the utilization of used batteries and tested on a wall clock. Testing was done with crushed water apple waste inserted into the battery, and the result was the wall clock could operate and last for one week starting from 12:55 on Saturday, April 27, until the wall clock finally stopped at 05:30 on Saturday, May 4. This proves that water apple waste can conduct electricity.

Water apple has a high water content which contains various ions such as Zn^{2+} and Cu^{2+} , thus can be used as an electrolyte or conductor of electricity. The water apple used in the experiment is rotten water apple, so the acid produced is higher than fresh water apples. This proves that fruit undergoing fermentation will increase the electrolyte strength in water apples.

Lime Waste

In lime, there are chemical contents including citric acid, amino acids, essential oils, glycolic acid, citron acid, sulfur, and vitamins B (thiamine), Vitamin C, and water. Lime (*citrus aurantiifolia*) is an electrolyte solution containing acidic compounds, thus potentially producing electrical energy. To prove this, an experiment was conducted using discarded batteries tested on a wall clock.

In the experiment, waste lime was crushed and inserted into the used battery. As a result, the wall clock could function and last for up to 2 days. Starting from Saturday, April 27, 2024, at 2:48 PM, until the clock eventually stopped on Monday, April 29, 2024, at 4:50 PM. This proves that lime waste can be utilized as an environmentally friendly alternative energy source (electricity).

Conclusion

Electrical energy is important for humans for daily use. Batteries are included as a source of electrical energy. Here we explore or conduct experiments regarding the comparison of using fruit waste from banana peel waste, water apple waste, and lime waste in experiments carried out on the use of used batteries and tested on wall clocks. After conducting research on the experiments carried out, it can be concluded that: banana peel, water apple, and lime can substitute manganese oxide or electrolyte in unused batteries so that the batteries can be reused. Utilizing batteries with fruit waste can reduce environmental damage. The electricity flowing in batteries using banana peels, water apple, and lime is caused by the transfer of charge differences between the positive and negative poles. Utilization of banana peel waste lasts from 15:20 to 18:45, while water apple waste lasts from April 27 at 12:55 to May 4 at 05:30. Meanwhile, lime waste lasted from April 27 at 14:48 until the wall clock finally stopped on Monday, April 29 at 16:50. Only lasting 2 days. Water apple has a high water content and contains various ions such as Zn^{2+} and Cu^{2+} , making it a potential good electrolyte or conductor of electric current. Meanwhile, lime contains organic acids such as citric acid, amino acids, and essential oils, which can enhance its electrical conductivity. On the other hand, banana peel contains electrolytes like potassium salts and chloride, albeit possibly in lower concentrations compared to water apple and lime. Therefore, water apple can generate more electricity compared to lime or banana peel due to its higher electrolyte content and better electrical conductivity.

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